MULTITRAIT SELECTION

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Beef cattle breeders sometimes find it difficult to know which individuals would be 'best' to become the parents of the next generation. Selection involves the evaluation of potential parents on functional efficiency, as well as many production traits, and some compromises among these traits are also needed. Selection in beef cattle on single traits is not advisable due to negative correlations between traits. For example, if cattle are selected only on weaning weight, chances are very good that cattle will become larger and birth weights become heavier, which might lead to difficult births. The solution to this problem is a multitrait selection – by selecting bulls that breed calves that wean heavy calves but not too heavy at birth. This is a simple example, but in practice, things could get much more complicated: heavy weaners are also dependant on cows with high milk production, etc.

One of the methods used to simplify the selection and select for multiple traits at once is to use a selection value, which combines breeding values of different traits into a single value. However, breeding values cannot simply be added together: some traits are economically more important and heritabilities of traits differ. Each trait is therefore scientifically weighed. Selection values take the advantages and disadvantages of traits into consideration in a balanced way. In addition to selection on production traits by using selection values, animals should also be visually inspected for functional efficiency traits like structural soundness and disposition.

Breeding the perfect cow

What are the characteristics of a perfect cow? She is fertile, calves easily and regularly, weans a heavy, strong, and healthy calf, while she has enough milk to sustain its growth. Her own body weight is in balance in relation to the weight of her calf, thereby ensuring a lower maintenance requirement and a more efficient animal. The Cow Value combines the weighted breeding values of these traits in a single value. However, to see the various strengths and weaknesses of an animal, the Cow Value (CV) is made up of the sub-values Calving Ease, Calf Growth, Milk, Female Fertility and Maintenance. Sub-values scientifically combine similar breeding values to simplify the selection of animals. For example, the EBVs for Heifer Fertility, Cow Fertility and Longevity are combined to form the sub-value Fertility by taking the heritability and economic importance into consideration. By using the sub-values, it is also easier to identify specialist bulls, for example, maternal bulls (daughters will raise a profitable calf every year). It is therefore essential to evaluate the sub-values for the Cow Value when selecting potential breeding bulls.

The Cow Value

The Cow Value places positive pressure on Weaning Weight and Milk, with negative pressure on maintenance (a combination of Mature weight and Milk production, as milk production is also an energy drain on the cow). Added to the fertility traits is Longevity, which not only measures fertility, but the number of acceptable calves that a cow produces.

EBV	Sub-value	
- **EBV** Birth Weight (Dir + Mat)	**Calving Ease**	
+ **EBV** Weaning weight	**Calf Growth**	**LOGIX COW VALUE**
+ **EBV** Milk	**Milk**	
- **EBV** Mature weight 0.75 – 0.1* **EBV** Milk	**Maintenance**	
- **EBV** Age 1st calf		
EBV Calving Interval	**Fertility**	
+ **EBV** Longevity		

Figure 1: *Schematic presentation of the breeding values included in the sub-values, which are then combined in the Cow Value. Whether positive or negative pressure is placed on the EBV are indicated by '+' and '-'. The actual weights are breed-specific.*

Figure 1 summarises the components of the Cow Value. The Cow Value and various sub-values are expressed in an index format, thus an animal with a sub-value of 110

for Fertility will genetically be above average compared to the live animals in the breed. The 'ideal' animal will theoretically have the highest possible positive values for all sub-values. Sub-values are scaled to indicate that above 100 values are generally in the more desirable direction, for example, a smaller calf at birth is more desirable and therefore has a higher calving ease value, and a smaller cow is more efficient and therefore also has a higher maintenance value. Both these traits however are optimal when average – so extremely high is also not beneficial, but this is counteracted in the cow value by the requirement of high calf growth.

PRACTICAL EXAMPLE

Table 1:

Selection values of 3 bulls with Cow Values of 120.

Bull	Calv-ing ease	Calf growth	Milk	Mainte-nance	Fertility	Logix Cow Value
1	120	105	97	112	104	120
2	82	132	109	91	100	120
3	113	98	119	91	125	120

Fertility: All three bulls have acceptable Fertility Values of above 100.

Maintenance: Bull 1 has a maintenance value of 112, indicating favourable maintenance, which usually means a smaller framed animal. Bulls 2 and 3 have values of 91, which mean they will breed larger-framed cows, although still within the average bracket (between 90 and 110).

Calf Growth & Milk: Bull 2 will breed the heaviest weaners, followed by Bull 1 and then Bull 3. The Milk of Bulls 1 and 2 are in balance with their Calf Growth (Milk should be more or less equal or a little lower than Calf Growth), while Bull 3's milk is higher relative to Calf Growth.

Calving Ease: Bulls 1 and 3 will breed smaller calves that are more easily born. Bull 2 will breed heavy birth weights and should not be used on heifers. He can however be used on larger, older cows if heavy weaners are desired.

Which bull is best?

As seen from previous discussions, traits cannot be seen in isolation. Bull 1 will be easy calving, breed heavier weaners and smaller-framed daughters. Milk is also in balance with Calf Growth. He will be a good choice. Bull 2 will generally breed larger cattle and are therefore suitable for good environments. Calves will be heavy at birth and weaning, and cows will be larger than average but still in balance (132 vs 91) with Calf Growth. Milk is in balance with Calf Growth. Bull 3 breeds average weaners from larger-framed cows, which is out of balance. Milk is also too high for Calf Growth. He will generally not be the better choice.

Conclusion

By using selection values, breeders can successfully select for multiple traits at the same time. It provides a systematic means for making selection decisions that are consistent with improved profitability. ■